Module Organisation
The module runs for 12 weeks of the academic year and comprises three lectures per week. Total contact time is 33 hours and 20 hours of experimentation.

Module Description
The purpose of this module is to equip students with basic and sophisticated mathematical tools for the analysis of neural data including EEG, MEG, fMRI and intracranial data. The tools will include harmonic analysis, filtering, independent component analysis and wavelets. All methods will be developed to answer specific questions on real data sets and the lectures will be accompanied by MATLAB-based analysis assignments throughout the semester. The scoring of the module will encourage this practical application of the methods by an even weighting of scores between the exam and the MATLAB-based assignments.

Prerequisites: 4C5 Digital Signal Processing

Learning Outcomes
On successful completion of this project the student will be able to:
1. Intuitively understand the meanings of the Fourier and Laplace Transforms.
2. Intuitively understand how filtering of digital signals works.
3. Analyse EEG data using the event-related potential technique and time-frequency methods.
4. Understand the meaning of fMRI and how to analyse it.
5. Derive graph theoretic measures of functional connectivity from neural data.
6. Build and test a computational model of a neural system.

Module Content
- The analysis of linear time-invariant systems.
- The sampling theorem.
- Noise and filtering.
- Electroencephalography: generators, analysis and interpretation.
- Intracranial data: sources, interpretation and analysis.
- Functional magnetic resonance imaging: origin of the BOLD signal and its analysis.
- Estimating connectivity patterns from neural signals.
- Computational modelling of neural systems.

Module Notes
Provided via Blackboard
**Teaching Strategies**
The course is lecture based, but a large emphasis is placed on accompanying MATLAB-based assignments. These assignments involve applying methods learned in lectures to real neural data.

**Experimental Strategy**
Students will be expected to complete an extensive training in recording of high quality, high density EEG data. This will involve up to 10 recording sessions on volunteer subjects so that they demonstrate competence in recording and analysis.

**Assessment Modes**
Written Exam (50%), and learning assignments (50%).

**Recommended Texts**